Institution: University of Ulster

Unit of Assessment: 16 Architecture, Built Environment and Planning

a. Context

The Built Environment Research Institute (BERI), University of Ulster (Ulster), and its constituent research centres: the Centre for Sustainable Technologies (CST), the Centre for Research on Property and Planning (RPP), Fire Safety Engineering Research and Technology (FireSERT) and Hydrogen Safety Engineering and Research (HySAFER) spans research activity across the built environment discipline. Transfer of research output embraces many different constituencies, audiences and networks. Users and beneficiaries include policy-makers, companies, the business sector and the wider community. Given the diversity of BERI's research portfolio, the main non-academic user groups are extensive, spanning regulatory bodies and industry in the manufacturing and production sectors (internationally, EU and UK) as demonstrated by case studies relating to sustainable technologies, fire, materials and hydrogen safety and in the areas of development, investment and policy as reflected by the regeneration case study. Impact is multi-dimensional and multi-tiered incorporating economic, commercial, organisational impacts; the environment; impacts on practitioners and professional services; and on policy, law and services.

b. Approach to impact

The University is committed to integrating research and innovation and embedding impact into all its activities through supporting knowledge driven research, encouraging creativity and facilitating the translation of research findings into products and services. BERI, in advancing the University's strategy, has a research culture that is applied in character, commercially/industrially relevant, aligned to the sector as reflected by professional bodies and has policy relevance. Research within BERI has been set in the context of major challenges concerning energy efficiency, the depletion of resources, sustainability, safety, the more frequent occurrence of extreme events as well as uncertainties arising from the financial crisis and market downturns. In responding to these, BERI has focussed upon issues relevant to these drivers and has sought solutions that reflect the highly varied and multi-faceted research portfolio. Staff within the submitted unit have utilised an extensive array of inter-linking strategies designed to develop relationships with key users in seeking to optimise the impact of our research. The approaches used by staff and supporting evidence, with examples, of the nature of these relationships are articulated below.

Disseminating research output has been a hallmark of the unit with the dual strategy of dissemination to the academy through the Ulster Institutional Repository and to end-users, the policy community and professional/industrial bodies. Numerous examples abound that characterise activities. For instance, a study on the Future of PPP and the PFI (RPP) funded by the Royal Institution of Chartered Surveyors (RICS), was launched to policy makers and the property, infrastructure, development and investment communities in Washington DC (June 2011), London (June 2011) and Delhi (August 2011) with a further invitation to lead a panel at the RICS Americas Conference (Miami, October 2012) and to engage in a high level policy forum in Washington DC (April 2013). Policy impact from this project and more widely from research on regeneration delivery vehicles, for example the UK Survey of Business Improvement Districts (BIDs), undertaken with British Bids, is central to the case study REGEN. A further exemplar is drawn from energy storage (DEL Cross Border R&D grant CST/RPP/HySAFER) which, as part of the dissemination strategy, hosted (February 2011) the International Energy Agency Task 42 Annex 24 meeting on Compact Thermal Energy Storage in parallel with the International Conference for Sustainable Energy Storage.

Collaborating in research with, or sponsored by, industry has been an integral part of BERI's strategy, designed to provide innovative solutions based on fundamental research. Examples of this strategy prevail across the submitted unit, selected illustrations include: FireSERT's work with Essexford Joinery on materials for fire doors and surface coatings for fire protection (case study FIRESAFE); European design rules for protected and unprotected cellular beams with the Arcelor Mittal (Luxembourg) and CTICM (France) (case study STRUCTURES); CST's collaboration with European Technology Development on a project for the Irish Electricity Regulatory Authority; the techno-economic performance of coal fired power plants with multinational corporations (Alstom, Doonson Babcock, Siemens), industry engagement through the use of KTPs, in the case of Copper Industries on thermal storage for renewable systems; with Unilever in connection with solar

technologies and subsequent adaptation of the research to the wine-making industry (case study SOLAR); HySAFER's involvement with key stakeholders in the sector such as Air Liquide, ITM Power, Volvo (case study HySAFETY).

Undertaking research for, or on behalf of, government departments/agencies (for example the Northern Ireland Housing Executive (NIHE), Department for Social Development NI (DSD), Invest Northern Ireland (INI), the Welsh Assembly Government) is a key part of the unit's strategy leading to direct access to public sector decision makers and influencing policy across matters pertaining to spatial planning, housing, property and energy. For example, property tax research has directly informed the policy agenda in NI, the UK and other jurisdictions whilst output from HySAFER has informed the creation of European regulations on hydrogen safety (case study HySAFETY).

Participating in and leading research networks/consortia and mutually beneficial partnerships has been an integral part of the unit's strategy with the objectives of enhancing profile, developing the research base and exposing output to wider constituencies. This strategy has been underpinned by extensive involvement in FP7 projects giving BERI significant presence in the European Research Area. For example HySAFER's leading role in European projects relating to hydrogen safety since 2004: the Network of Excellence HySafe (case study HySAFETY), FireSERT's role in PredFIRE-NANO and ENFIRO projects (case study FIRESAFE) with industry partner (IRIS Vernici), RPP's involvement in BESECURE (urban security with industry partners ITTI, TNO) and CST engagement with Tecnalia, VITO and Fraunhofer ISE (MERITS project).

Pooling research expertise with other institutions to achieve specific research objectives and impacts as exemplified by the unit's (RPP) founding (with NUI Maynooth and the Centre for Urban Development, Cambridge, Mass.) and leading role in the International Centre for Local and Regional Development (ICLRD), a North-South-US partnership created to explore and expand the contribution that planning and the development of physical, social and economic infrastructures can make to improving the lives of people in both Irish jurisdictions. Research reports and outputs produced through ICLRD have informed spatial planning policy through the island of Ireland.

Engaging with the private sector and professional bodies/associations to promote leading edge research with benefit for practice and policy formation. The unit, through RPP and the Real Estate Initiative (REI) (a partnership between the University and donors in the investment, development and banking sectors launched in February 2008), has provided objective analysis to stakeholders and the policy community in a period of market re-alignment. REI-led discussion forums have provided a platform for objective debate and generated research priorities across stakeholder groupings leading to pro-active engagement with policy makers (including the First Minister for NI, the Finance Minister, the Chief Executive of Invest NI), government departments (Department of Finance and Personnel NI (DFP), DSD, Department of Enterprise, Trade and Investment NI (DETI) and institutional bodies/representatives (RICS, Council of Mortgage Lenders)).

Responding to the policy agenda through government consultation documents has been a key part of the unit's strategy. Several staff members have acted as ministerial advisors, serve on ministerial advisory groups and All Party Working Groups, provide evidence to select committees (planning, regeneration, housing and energy areas) or serve on other policy fora. Evidence on energy consultations, spatial planning, regeneration and property taxation are cited in Hansard; an example being evidence provided to the Social Development Committee (NI Assembly) in November 2012 on the outcomes of research on BIDs (REGEN case study) as part of the Assembly's drafting of BIDs legislation.

Exploiting the commercial potential of research through patents, licenses, Proof of Concept (PoC) (with Invest NI), Proof of Principle (PoP) (seed corn funding for projects with commercial potential through the University's Office of Innovation (OoI)) and involvement with industry utilising KTP and Fusion (InterTradeIreland's all island knowledge transfer programme) and development of spinout companies (Solarform Ltd, Vifkon Ltd) is strongly promoted through the University's innovative policies and practices. Examples include projects with Copper Industries (Ireland) Ltd (KTP) and Envirotech and Fingleton White (Fusion). In total, 7 PoCs and 8 PoPs were funded and multiple patent applications were filed over the assessment period. Examples include Solar Water Heater (GB 0820369.7) (SOLAR case study), Evacuated Photovoltaic Glazing Panel (GB1002721.7), Fire Blast Protection System using Ultra High Performance Hybrid Reinforced Ferrocement Panels (GB1117162.6), Safety Valve for Flammable Gas (GB1005376.7) and Gas Storage (GB2012/050895) (HySAFETY case study). Memoranda of Understanding which have been in operation over the assessment period include those with industry partners, for example Glaseal

(glazing research) or other research organisations as in the case of the Korean Evaluation Institute of Industrial Technology (FireSERT). Public meetings, organised with Invest NI, have been used to showcase research in sustainable technologies, industrial liaison committees have supported local initiative development and innovation vouchers have linked companies to BERI's research and consultancy. For example, in FireSERT work on the fire safety improvement of various materials (wall panels, insulation, mattresses, fire doors: FIRESAFE case study) has been funded by industry and INI innovation vouchers. Wider engagement with elected public representatives included BERI's participation in a showcasing event at Parliament Buildings (NI Assembly) in February 2013 and with local government, as illustrated by collaboration with Belfast City Council in the development of a 3D model to provide digital representation of the city.

Embracing innovation competitions as evidenced by SolaCatcher, a low cost solar water heating system developed in CST, a finalist in the Make it in Great Britain challenge 2012 (case study SOLAR). Fire Blast, a dual function system designed to provide protection against fires and blasts, developed in FireSERT, winning the Hi Tech section of 25K award (The Search for the next big thing) organised by NI Science Park, October 2012 and shortlisted (January 2013) as a finalist in the prestigious Irish Times Innovation Award.

Delivering short courses and executive education for policy makers. Examples that provide a flavour of this activity include European summer and technical schools on hydrogen safety targeted to end-users including regulators and public sector officials (HySAFETY case study), GIS applications for local authorities in NI as part of up-skilling for the Reform of Public Administration, fire safety training workshop (STRUCTURES case study) and low carbon technology for buildings workshop showcasing CST's expertise.

The unit positively supports staff engagement in these strategies as part of the process of translating research and knowledge into intellectual assets ranging from dissemination of research through to the ability to capitalise upon outputs. There are three elements of support to complement staff expertise: financial, time and administrative assistance. First, financial support is available through BERI's recurrent budget from which staff can bid for strategic use of funds. In addition, the University through the Research Office (RO) and the OoI has an annual funding call for Research Impact Awards and Innovation Impact Awards specifically designed to facilitate the demonstration of impact and awarded on a competitive basis. Funding from these sources has contributed to the achievement of impact in varying ways. For example the Research Impact Award 'Energy Solver' facilitated CST in co-hosting, with Invest NI, a workshop on product development, including research underpinning the SOLAR case study, which attracted 86 companies and public sector bodies embracing the research community, industry and policy makers. Strategic funding was utilised to help secure the conference of the International Academic Association on Planning, Law and Property Rights (February 2012), the theme "Rights, responsibilities and equity in land use planning" capturing property interests in land and property and policy impacts. External funding support, including donor funding through REI and ICLRD, has been utilised to generate impact through reports, hosting workshops and seminars, and meetings with government ministers and officials to address critical issues relating to policy responses concerning the property, construction and financial sectors. As an example, production of the commercial property report for NI (with the Investment Property Databank) was an initiative flowing from the meeting with NI's First Minister and advanced through REI with a chain of activity involving InvestNI, several government departments and Belfast City Council. Second, support through the School of the Built Environment's (SBE) workload model which, in seeking to balance staff time, has been highly sensitive to the importance of research led activities and is designed to encourage staff to be research active, a strategy facilitated by close working relationships between the RI and SBE. Third, administrative support through central University departments and the Faculty is complemented by the BERI office and secretarial provision within research centres. At the institutional level, the University, through its Corporate Plan 2011/12 to 2015/16, is committed to supporting research excellence and innovation with the translation of knowledge into intellectual assets. This goal is supported by an infrastructure, the RO and the OoI, designed to encourage the process of generating impact. The OoI and its knowledge venturing company Innovation Ulster Limited provides a focus for commercial collaborations and facilitates business and industry linkages. Staff members in the unit have benefitted from and made significant use of this support.

c. Strategy and plans

The mission of BERI is excellence in the delivery of research that enhances the quality of the built environment and addresses the complex interactions that exist with society. Strategy and plans recognise that past practices, behaviours and expectations may no longer apply and that research plays an ever increasing role in shaping the new built environment. Economic conditions, investment, public policy, government expenditure, societal expectations and environmental limits have all changed the context within which the built environment operates and provides the benchmarks against which current and future research plans for BERI are based. The research strategy for the unit is founded on principles of sustainability, the resilience of built structures, infrastructure provision that reflects broader green priorities and in which the potential of renewable energy, smart grids, 'green' infrastructure and connected, low carbon lifestyles are core elements. Within this context, BERI will continue to engage with and incorporate questions of equity and social inclusion into its work allied to the technological and scientific expertise within the unit.

The overarching goal for BERI is that the research undertaken, its outputs and consequences actively shape the new built environment and provide solutions to the complex issues and challenges facing society. The plan for continuing research impact is two-fold. Firstly, to embrace pro-active engagement at different levels by furthering and developing the strategies that BERI already is undertaking and, as articulated in the previous section, forging strong relationships with industry, the professions, regulatory bodies, policy makers and the wider community and through demonstrable research activities provide agenda-setting leadership. Secondly, to create the conditions to ensure that impact is fully capitalised upon whether this is through changes in policy (legislative or regulatory changes) or via product development and innovation. Communication, connectivity and collaboration are fundamental aspects of the plan to effectively translate impact into products and services and maximise potential societal gains from built environment research.

In implementing plans to support impact, the unit will continue to engage with the University's OoI and Invest NI, utilise Proof of Principle and Proof of Concept funds where typically 20% is devoted to exploitation support (marketing, IPR). Links to industry will be formalised through MoUs and Non-Disclosure Agreements, options for licensing and spin-out capability will be actively pursued with dissemination to the varied range of stake-holders that benefit from our research.

d. Relationship to case studies

The applied nature of research within the submitted unit whether from a technological perspective or from a policy dimension allows close mapping between the approach adopted and strategies used to both generate impact and capture the potential benefit of the impact. These relationships have been demonstrated by the cross-linkage of particular strategies to impact case studies as evidenced in the Approach to Impact (Section b). Strategies of **engaging** with private sector interests (institutions, investors), **undertaking** research for public sector agencies (Department for Communities and Local Government and departments within the devolved countries of the UK) and professional bodies (RICS), **responding** to and informing the policy agenda, **disseminating** output through different forum internationally has directly input into the case study on regeneration (REGEN). **Collaborating** with industrial partners, **engaging** with governing bodies, **exploiting** the commercial potential of patents and products and **embracing** competitions are illustrated by the case study on solar energy applications in the wine industry (SOLAR). The case study on cellular steel beams under fire conditions (STRUCTURES) is characterised by **collaborating** with industry and influencing the development of European design guidance, **delivering** these new European guidelines through training courses, and **exploiting** commercial potential. The FIRESAFE case study integrates fire safety for the general consumer and building products through **collaborating** with industry, **exploiting** commercial potential and **undertaking** research with societal benefit through product design that meets new stringent environmental and fire hazard regulations. Likewise, the HySAFETY case study through **collaborating** with industry demonstrates impact through the development of regulations, codes and European standards for hydrogen safety, **participating** in networks on safety, **exploiting** commercial potential through patents and **delivering** training courses to the sector. These deliberate strategies over a sustained period have generated impact beyond the academic confines of the discipline and are influencing and promoting change within a wider social, economic and environmental context.